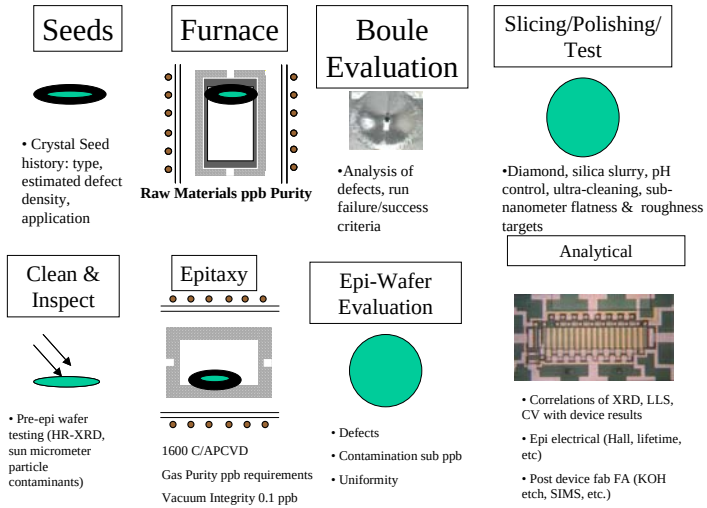
Innovative Silicon Carbide Materials Technologies High Power Device Applications
Dow Corning Corporation

SiC Crystal Growth and Wafer Fab: Process Flow & Challenges



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Goals, Objectives and Main Technical Approach

Objective: Develop technology 4H SiC substrate and epitaxy technologies which will enable fabrication of high power SiC devices of capable of blocking voltages exceeding 10 KV .

Technical Approach:

Advance traditional PVT based growth processes to expand seed crystals to 3-4” diameter. Inspect and insert higher quality seeds into high purity PVT growth processes for SiC boules and subsequently wafering processes.

Develop fast, high-density wafer mapping metrology strategies to characterize wafer shape, defects and electrical properties.

Implement and adapt commercial hot wall, SiC specific CVD epitaxy tool to thick SiC epitaxy (>100 um) on 3-inch 4H n+ SiC wafers

Deliver wafers to device technology partners; develop point-by-point links between wafer properties and key device properties. Use information to drive wafer specification processes and wafer improvement roadmaps.

Key Accomplishments

•3-inch 4H n+ SiC wafers with within wafer resistivity variations <5% and >90 % FQA

•Developed in-situ gas etching chemistry to minimize growth pits in thick CVD SiC epitaxy on 4H SiC wafers.

•Implemented CVD SiC homoepitaxy chemistry to commercial reactor for films with thickness>100 um, N_d-N_a<1E15/cm^3 and thickness uniformity <10% on 3” wafers.

Major Impact of Technology & Technology Transition Plan

Dow Corning is currently completing consolidation and start-up of the new Michigan semiconductor wafer fabrication manufacturing facility. Volume manufacturing of 4H and 6H SiC boules (50-100mm), high volume polishing, and automated wafer defect inspection is scheduled to start in Q4-2004. R&D SiC epitaxy on 50-75 mm wafers will continue throughout 2004, and qualification and capacity expansion is expected for manufacturing in early 2005. Dow Corning will proactively interact and partner with the members of the government, commercial and R&D WBGS community to develop test capability and wafer specification roadmaps and support its customers with the delivery of known good SiC wafers/epitaxy for use in materials R&D, government and commercial semiconductor device applications.